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The Chesapeake Bay Program
Project Summaries

Geomet, Inc.
Gaithersburg, MD

Prepared for

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Annapolis, MD

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16. ABSTRACT

"The Chesapeake Bay Program, Project Summaries," is a compilation of 44 1-page reports assembled to give the reader administrative data including performing organization, principal investigator, project officer, project period, project number and funding and summaries discussing the objectives, scientific approach, and products for each project.

The report is divided into seven separate areas: (1) Toxics, (2) SAV, (3) Eutrophication, (4) Environmental Management, (5) State Participation, (6) Public Participation, and (7) Data Management. Each area includes a brief introduction explaining the importance of the study in relation to the Chesapeake Bay Program. The Project Summary gives the reader an idea of the major research activities currently underway, and the efforts being made to solve the water quality problems of the Chesapeake Bay.

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THE CHESAPEAKE BAY PROGRAM

Project Summaries

Contract Number 68-01-4144

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CHESAPEAKE BAY PROGRAM
OFFICE OF RESEARCH AND DEVELOPMENT
AND
MID ATLANTIC REGION III
U.S. ENVIRONMENTAL PROTECTION AGENCY

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FOREWORD

The U.S. Environmental Protection Agency is pleased to present you an account of our research and management projects presently underway in the Chesapeake Bay Program. This report covers currently funded projects that are being conducted for the period from October 1, 1977 through October 15, 1981 and should guide the reader to a better understanding of our program. "The Chesapeake Bay Program - Project Summaries" is written in nontechnical terms for the general public; it is designed to give the reader an overview of the steps being taken by the CBP to identify and resolve some of the Bay's water quality problems.

The report begins with an introductory statement on program authority, funding, organizational structure, objectives and study areas. General information on seven study areas follows. Specific features of all ongoing research projects in each study area, including basic objectives, scientific approach and expected products, comprise the main body of the text. Should you desire more detailed information on any of these projects, please contact the Project Officer cited in the report.

Any study program of this complex a nature requires the help and cooperation of the public, Bay users, governmental (Federal, state and local) and scientific communities. We are fortunate to be working in an environment where these diverse sectors are pulling together to achieve a common goal -- a better Bay for present as well as future generations. The time and effort they have given is greatly appreciated.

Tudor T. Davies
Program Director

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INTRODUCTION

The Chesapeake Bay, one of the largest estuarine systems in the world, encompasses some 7,000 miles of shoreline and a surface area of about 4,300 square miles. The Bay receives its major freshwater input from the Susquehanna, Patuxent, Potomac, James and Rappahannock Rivers. It serves as a recreational resource, home for oysters, crabs and fish, a source for minerals and cooling waters, a channel or transportation link and a natural assimiliative sink for waste disposal.

Recognizing that the Chesapeake Bay is a unique and fragile national resource subject to heightened competition among potential users as Bay-area populations continue to expand rapidly, the 94th Congress authorized EPA to conduct an indepth study of the Chesapeake Bay to assess the principal factors having adverse impacts on its environmental quality and to direct and coordinate a program of research and abatement that will efficiently address those factors.

EPA implemented this initiative through the Chesapeake Bay Program (CBP) which is focused upon (1) identifying and improving governmental coordination and participation, (2) coordinating pollution research to identify source, transport, fate, physical properties and control alternatives, (3) developing and maintaining a two-way dialogue with the Bay public to assure that the Government is responsive to the interests of the citizens, and (4) directing all phases of data management from collection through analysis and information dissemination.

In keeping with the traditional partnership atmosphere that has characterized the CBP from its outset, EPA and representatives from the State Water Control Board in Virginia and the Water Resources Administration in Maryland, along with Bay area citizens, met during October 1977 for a 3-day workshop to define the future research areas for the Program. The purpose was to identify Bay-area environmental problems and define a management structure for the Bay Program that ensured the continued and full involvement of the State agencies and the public throughout all phases of the Program.

The significant products of that intensive workshop were: (1) the identification of 10 problem areas threatening the environmental health of the Chesapeake Bay, and (2) the definition of a management structure that includes EPA, State personnel and interested citizens on a hierarchical series of committees and work groups that range from policy setting to working staff level arrangements.

In the technical program areas, 10 major study areas were identified:

(1) High Priority

- (a) Toxics
- (b) Eutrophication
- (c) Submerged Aquatic Vegetation

(2) Medium Priority

- (a) Shellfish Bed Closure
- (b) Fisheries Modification
- (c) Dredging and Spoil Disposal
- (d) Hydrologic Modifications

(3) Low Priority

- (a) Wetlands Alteration
- (b) Shoreline Erosion
- (c) Water Quality Effects of Boating and Shipping.

Because of funding limitations, the Program has, to date, focused upon the high priority areas. They are described in more detail in the body of the text. In addition to the program areas outlined, the separate category of data management was funded to provide information storage/retrieval services for all aspects of the Program.

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FUNDING SUMMARY*

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
TOXICS			
Chesapeake Bay Earth Science Study - Sedimentology of the Chesapeake Bay (21)	$ 247,613	$ 175,588	$ 423,201
Baseline Sediment Studies to Determine Distribution, Physical Properties, Sedimentation Budgets and Rates (22)	600,517	31,606	632,123
Chesapeake Bay Sediment Trace Metals (23)	143,765	14,361	158,126
The Characterization of the Chesapeake Bay - A Systematic Analysis of Toxic Trace Elements (24)	150,000	-0-	150,000
Investigation of Organic Pollutants in the Chesapeake Bay (25)	772,412	50,736	823,148
Chesapeake Bay Earth Science Study - Interstitial Water Chemistry (26)	341,054	159,967	501,021
Sediment and Pore Water Chemistry (27)	71,674	4,931	76,605
Monitoring Particle-Associated Toxic Substances and Suspended Sediment in the Chesapeake Bay (28)	119,592	6,294	125,886

* Includes currently funded projects being conducted during the period 10/01/77 through 10/15/81.

(Continued)

FUNDING SUMMARY (Continued)

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
Fate, Transport and Transformation of Toxics: Significance of Suspended Sediment and Fluid Mud (29)	$ 197,879	$ 10,403	$ 208,282
Chesapeake Bay Earth Science Study - Animal Sediment Relationship (30)	117,473	46,653	164,126
The Biogenic Structure of Chesapeake Bay Sediments (31)	76,587	8,065	84,652
Investigation of the Chester River Oyster Mortality (32)	83,750	11,918	95,668
Inventory and Toxicity Prioritization of Industrial Facilities Discharging into the Chesapeake Bay Basin (33)	83,356	-0-	83,356
Total Toxics Program	$ 3,005,672	$ 520,522	$ 3,526,194
SUBMERGED AQUATIC VEGETATION			
Distribution of Submerged Vascular Plants in the Chesapeake Bay, Maryland - 1978 (35)	$ 137,397	$ 9,022	$ 146,419
Distribution and Abundance of SAV in the Lower Chesapeake Bay, Virginia - 1978 (36)	68,681	4,066	72,747
Distribution and Abundance of Submerged Aquatic Vegetation in the Lower Chesapeake Bay - 1979 (37)	18,436	1,214	19,650

(Continued)

FUNDING SUMMARY (Continued)

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
Distribution of Submersed Aquatic Vegetation in Chesapeake Bay, Maryland - 1979 (38)	$ 56,430	$ 2,970	$ 59,400
Biostratigraphy of the Chesapeake Bay - A Feasibility Study (39)	134,675	7,088	141,763
Biostratigraphy of the Chesapeake Bay and Its Tributaries (40)	99,285	5,225	104,510
Zostera marina: Biology, Propagation and Impact of Herbicides (41)	321,815	41,699	363,514
Submerged Aquatic Vegetation in the Chesapeake Bay: Its Role in the Bay Ecosystem and Factors Leading to Its Decline (42)	639,311	170,371	809,682
The Functional Ecology of Submerged Aquatic Vegetation in the Lower Chesapeake Bay (43)	649,409	74,533	723,942
Studies on the Value of Vegetated Habitats and Their Roles as Nursery Areas and Shelter from Predation with Emphasis on Utilization by Commercially Exploited Species (44)	48,726	2,565	51,291
Assessment of the Potential Impact of Industrial Effluents on Submerged Aquatic Vegetation (45)	140,027	-0-	140,027

(Continued)

FUNDING SUMMARY (Continued)

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
Effects of Recreational Boating Turbidity and Sedimentation Rates in Relationship to Submerged Aquatic Vegetation (46)	$ 28,613	-0-	28,613
Factors Affecting and Importance of Submerged Aquatic Vegetation in the Chesapeake Bay (47)	228,372	-0-	228,372
Total SAV Program	$ 2,571,117	$ 318,753	$ 2,889,870
EUTROPHICATION			
Definition of Chesapeake Bay Problems of Excessive Enrichment or Eutrophication (50)	$ 360,411	$ 23,921	$ 384,332
An Assessment on Nonpoint Source Discharge, Pequea Creek Basin, Lancaster County, Pennsylvania (51)	191,002	13,211	204,213
Evaluation of Water Quality Management Tools in the Chester River Basin (52)	543,340	64,208	607,548
Intensive Watershed Study (Patuxent River Basin) (53)	452,340	67,806	520,146
Evaluation of Management Tools in Two Chesapeake Bay Watersheds in Virginia (54)	999,240	110,033	1,109,273

(Continued)

FUNDING SUMMARY (Continued)

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
Modeling Philosophy and Approach for Chesapeake Bay Program Watershed Studies (55)	50,431	-0-	50,431
Fall Line Monitoring of the Potomac, Susquehanna and James Rivers (56)	$ 423,000	$ -0-	$ 423,000
Assessment of Nutrients from Various Sources (57)	15,000	-0-	15,000
Land Use and Point Source Nutrient Loading in the Chesapeake Bay Region (58)	20,308	-0-	20,308
Chesapeake Bay Circulation Model (59)	249,949	-0-	249,949
Water Quality Laboratory for Chesapeake Bay and Its Subestuaries at Hampton Institute (60)	315,521	16,606	332,127
Total Eutrophication Program	$3,620,542	$ 295,785	$ 3,916,327
ENVIRONMENTAL MANAGEMENT			
Preparation of a Strategy and Plan of Action for Designing the Research of Management Resources for the Chesapeake Bay Area (62)	14,336	1,110	15,446
Environmental Management in the Chesapeake Bay (63)	150,802	8,122	158,924
Total Environmental Management Program	$ 165,138	$ 9,232	$ 174,370

(Continued)

FUNDING SUMMARY (Concluded)

Project Title (Page Number)	Resources ($) EPA Share	Performing Organization Share	Total
STATE PARTICIPATION			
Development and Coordination of Technical Assessments, Scientific Planning and Data Organization for the Chesapeake Bay Program - State of Maryland (65)	$ 338,130	$ 18,670	$ 356,800
Data Organization, Technical Support and Coordination for the Environmental Protection Agency's Chesapeake Bay Program - Commonwealth of Virginia (66)	323,215	36,600	359,815
Total State Participation	$ 661,345	$ 55,270	$ 716,615
PUBLIC PARTICIPATION			
Chesapeake Bay Program's Public Participation Program (68)	$ 283,407	$ 20,197	$ 303,604
Chesapeake Bay Program's Public Participation Program (69)	383,704	30,197	413,901
Total Public Participation Program	$ 667,111	$ 50,394	$ 717,505
DATA MANAGEMENT			
Automated Data Processing Support for the Chesapeake Bay Program (71)	$ 167,000	-0-	$ 167,000
Total Data Management Program	$ 167,000	$ -0-	$ 167,000
TOTAL PROJECT FUNDING	$10,857,925	$1,249,956	$12,107,881

TOXICS PROJECTS

TOXICS PROGRAM AREA

Toxic substances represent an obvious threat to the stability and continued use of Chesapeake Bay resources. Recognition of the role of toxics in the ecological health of the Bay system requires a thorough understanding of the chemical, physical, and biotic dynamics that form the total estuarine system. Definitive information on sources, pathways, and fate of toxic substances is scarce, and where available, is usually limited to specialized problems in restricted areas. The Chesapeake Bay Program is filling this information gap by studying toxic substances from industrial, agricultural and aerial sources and their behavior within the estuarine system.

Accumulation of toxics in food chains and the potential health/economic effects are a primary concern. The toxics study effort is addressing this concern by developing a baseline inventory of the abundance and distribution of toxics in the sediments, pore water, water column, and biota. Comprehensive research tasks are being conducted to assess both natural and anthropogenic sources of toxic chemicals in sediments, water, and biota and to determine their rates of transport and transformation within the Chesapeake Bay system. Identified problem areas will receive intensive investigation, and study results will serve to delineate management options to reduce environmental hazards.

CHESAPEAKE BAY EARTH SCIENCE STUDY -
SEDIMENTOLOGY OF THE CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):
Randall T. Kerhin

PROJECT NUMBER:
R805965

PERFORMING ORGANIZATION:
Maryland Geological Survey
Chesapeake Bay Earth Science Study
The Johns Hopkins University
Baltimore, MD 21218

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$247,613
Performing Organization Share	175,588
TOTAL	$423,201

PROJECT PERIOD:
Begin - 7/24/78
End - 7/23/80

OBJECTIVES:

This is a companion project of work being performed by the Virginia Institute for Marine Science for Virginia waters under grant number R806001 (page 22). This project has three objectives: (1) determining the distribution and physical properties of Bay sediments, (2) identifying sites of erosion and deposition in the Upper Bay, and (3) developing a total sediment budget for the Bay. This study is concerned with the Maryland portion of the Chesapeake Bay, and also provides a coordinating base for other Maryland Geological Survey efforts in the Toxics Program.

SCIENTIFIC APPROACH:

Surficial sediment samples are collected from a 1 kilometer grid network that spans the Maryland portion of the Bay. These samples are analyzed for various physical, chemical and mineralogical characteristics. The field program is separated into two simultaneous operations: nearshore (water depths less than 3 meters), and offshore (water depths in excess of 3 meters).

Comparisons between historical and contemporary bathymetric data for this portion of the Bay will help identify areas of erosion/deposition by mapping changes in water depth due to accumulation/removal of material.

PRODUCTS:

Study products include baseline mapping of sediment features, mapping of erosional/depositional patterns, and a total sediment budget for the Bay. Detailed features will be plotted at a scale of 1:20,000; regional effects will be plotted at a scale of 1:40,000. Support documentation will be available in both tabulated and computer-compatible forms.

BASELINE SEDIMENT STUDIES TO DETERMINE DISTRIBUTION, PHYSICAL PROPERTIES, SEDIMENTATION BUDGETS AND RATES

PRINCIPAL INVESTIGATOR(s):
John M. Ziegler

PERFORMING ORGANIZATION:
Department of Geological Oceanography
Virginia Institute of Marine Science
Gloucester Point, VA 23062

PROJECT NUMBER:
R806001

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$600,517
Performing Organization Share	31,606
TOTAL	$632,123

PROJECT PERIOD:
Begin - 7/10/78
End - 7/09/80

OBJECTIVES:

This is a companion project of work being performed by the Maryland Geological Survey for Maryland waters under grant number R805965 (page 21). This project has three objectives: (1) determining the distribution and physical properties of Bay sediments, (2) identifying sites of erosion and deposition in the Lower Bay, and (3) developing a total sediment budget for the Bay. This study is concerned with the Virginia portion of the Chesapeake Bay. It provides a coordinating base for other Virginia Institute of Marine Science efforts in the Toxics Program.

SCIENTIFIC APPROACH:

Surficial sediment samples are collected from a 1 kilometer grid network that spans the Virginia portion of the Bay. These samples are analyzed for various physical, chemical and mineralogical characteristics. The field program is separated into two simultaneous operations: nearshore (water depths less than 3 meters), and offshore (water depths in excess of 3 meters).

Comparisons between historical and contemporary bathymetric data for this portion of the Bay will help identify areas of erosion/deposition by mapping changes in water depth due to accumulation/removal of material.

PRODUCTS:

Study products include baseline mapping of sediment features, mapping of erosional/depositional patterns, and a total sediment budget for the Bay. Detailed features are to be plotted at a scale of 1:20,000; regional effects will be plotted at a scale of 1:40,000. Support documentation will be available in both tabulated and computer-compatible forms.

CHESAPEAKE BAY SEDIMENT TRACE METALS

PRINCIPAL INVESTIGATOR(s):
George R. Helz

PROJECT NUMBER:
R805954

PERFORMING ORGANIZATION:
Department of Chemistry
University of Maryland
College Park, MD 20742

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$143,765
Performing Organization Share	14,361
TOTAL	$158,126

PROJECT PERIOD:
Begin - 7/17/78
End - 7/16/80

OBJECTIVES:

This project seeks to perform a geochemical survey of sediments in select portions of the Chesapeake Bay that will: (1) establish the present trace metal composition of Bay sediments, (2) allow estimation of the depositional flux of individual trace metals to the Bay bottom, and (3) permit compilation of an improved trace metal mass balance.

SCIENTIFIC APPROACH:

Samples of surficial bottom sediment are secured along approximately 15 east-west traverses spaced equally along the entirety of the Bay. The resulting sample set is analyzed for trace metal content via atomic absorption spectrometry. Quality assurance techniques will reference all measurements to the National Bureau of Standards industrial river sediment standard.

About 15 sediment cores from selected stations throughout the Bay will be analyzed by Pb_{210} deposition rate determinations. Vertical profiles of trace elements are determined by plasma emission spectroscopy. These data allow a cross-check of surface sediment analysis and also serve to establish historical changes in the profile.

The bulk of sample collection is performed by the Maryland Geological Survey, grant number R805965 (page 21) and the Virginia Institute of Marine Science, grant number R806001 (page 22).

PRODUCTS:

Final products of this study include maps depicting the present chemical quality of Bay sediments with respect to selected trace metals; a report will discuss trace metal sources, transport and sinks in the light of experimental findings.

THE CHARACTERIZATION OF THE CHESAPEAKE BAY: A SYSTEMATIC ANALYSIS OF TOXIC TRACE ELEMENTS

PRINCIPAL INVESTIGATOR(s):

C. C. Gravatt*
Howard Kingston

PROJECT NUMBER:

EPA-79-D-X0717
Interagency Agreement

PERFORMING ORGANIZATION:

Office of Environmental Measurements
Room A347, Chemistry Building
National Bureau of Standards
Washington, D.C. 20234

EPA PROJECT OFFICER:

Lowell Bahner

BUDGET:

EPA Share $150,000
TOTAL $150,000

PROJECT PERIOD:

Begin - 3/26/79
End - 3/25/80

OBJECTIVES:

The objective is to provide analytical data to assist in determining the concentrations of up to 12 trace elements in the waters of the Bay.

SCIENTIFIC APPROACH:

Several methodologies (graphite furnace atomic absorption, isotope dilution spark source spectrometry, neutron activation analysis) will be used to identify and quantitate a variety of elements. Collection of samples is on a regular 1 kilometer grid covering the entire Bay. Grid locations and dates of sampling are coordinated with sampling operations of other projects to obtain data of maximum value in developing a model of the Bay. At each location both top and bottom samples will be taken and filtered to give suspended particulate and dissolved metal samples. In addition discharges into the Bay from the Potomac and Rappahannock Rivers will be sampled to provide data on sources and amounts of metals entering the Bay.

The elements chosen for initial work are copper, lead, zinc, cadmium, manganese, molybdenum, nickel, chromium, tin, mercury, arsenic and selenium.

Additional samples will be collected at each site for storage in a sample bank.

PRODUCTS:

Products include data on the concentrations of 12 key trace elements on the top and bottom of the water column at precisely defined locations in the Bay.

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* Project Manager.

INVESTIGATION OF ORGANIC POLLUTANTS IN THE CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):
Robert J. Huggett

PERFORMING ORGANIZATION:
Ecology Pollution Department
Virginia Institute of Marine Science
Gloucester Point, VA 23062

PROJECT NUMBER:
R806012

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$772,412
Performing Organization Share	50,736
TOTAL	$823,148

PROJECT PERIOD:
Begin - 7/17/78
End - 7/16/80

OBJECTIVES:

The objective of this project is to establish a system to detect, identify, and quantify toxic organic compounds of significance in the water column, in sediments, and in mollusk tissues from the Chesapeake Bay.

SCIENTIFIC APPROACH:

The first year is devoted to technique development (chemical procedures, apparatus, software development). Samples of sediment and mollusks are collected once the first year and semiannually thereafter. Water samples are collected twice the first year and seasonally thereafter. Sampling stations are distributed throughout the Bay.

An online computer system performs the bulk of the data management tasks. The gas chromatrographic/mass spectra data will contain information on both identified components (i.e., those on the EPA consent decree priority pollutants list) and unidentified components. The program takes note of both classes of compounds, allowing assessment of accumulations of recognized toxics and maintaining a capability to perceive alarming rates of increase in other compounds that may force identification and further action.

PRODUCTS:

Study results will include a baseline depiction of the abundance and distribution of toxic organics in the water column, sediments, and mollusks of the Bay system. Additionally, some previously unknown toxic organics may be identified. Finally, the availability of a functioning surveillance system for these toxic compounds will assist in making resource management decisions.

CHESAPEAKE BAY EARTH SCIENCE STUDY - INTERSTITIAL WATER CHEMISTRY

PRINCIPAL INVESTIGATOR(s):
Owen P. Bricker

PROJECT NUMBER:
R805963

PERFORMING ORGANIZATION:
Maryland Geological Survey
The Johns Hopkins University
Baltimore, MD 21218

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:
EPA Share $341,054
Performing Organization
Share..... 159,967
TOTAL.....$501,021

PROJECT PERIOD:
Begin - 7/01/78
End - 6/30/80

OBJECTIVES:

Interstitial water is a vehicle by which trace metals, nutrients, and soluble sediment constituents may be transported across the sediment/water interface. The four major project objectives are: (1) characterization of the composition as well as variations in the chemistry of interstitial water as a function of sediment type and position along the salinity gradient, (2) identification of sediment particle mineralogy, (3) interpreting the reactions that occur between the solid phases and the interstitial waters that control concentrations of dissolved species in the system, and (4) determining the mechanisms as well as assessing the extent of transfer across the sediment/water interface.

SCIENTIFIC APPROACH:

Approximately 100 sediment cores are being collected along a series of east-west transects of the Bay. Each core yields 10 samples spaced evenly over the topmost meter of sediment. Interstitial water is squeezed from each of the samples. Residual (squeezed) mud is analyzed for carbon content, sulfur content, and mineralogy. Each interstitial water sample undergoes electrode analyses (pH, Eh, $pS^{=}$). The Maryland Geological Survey laboratory analyzes each sample for trace metals, silica, and sulfate. Professor S.Y. Tyree Jr., of the College of William and Mary (project number R805966, page 27), performs analyses for alkalinity, major cations, and nutrients.

PRODUCTS:

This study will provide: (1) a baseline assessment of trace metals and nutrients in the interstitial waters of Bay sediment, (2) an evaluation of the significance of bottom sediment as a source of nutrients and metals to the estuary, (3) data necessary to correlate sediment chemistry with metals content of benthic fauna, and (4) data necessary to the modeling of trace metal behavior in the estuarine environment.

SEDIMENT AND PORE WATER CHEMISTRY

PRINCIPAL INVESTIGATOR(s):

S. Y. Tyree, Jr.

PERFORMING ORGANIZATION:

Department of Chemistry
College of William and Mary
Williamsburg, VA 23185

PROJECT NUMBER:

R805966

EPA PROJECT OFFICER:

Lowell Bahner

BUDGET:

EPA Share	$ 71,674
Performing Organization Share	4,931
TOTAL	$ 76,605

PROJECT PERIOD:

Begin - 7/01/78
End - 9/30/80

OBJECTIVES:

This project provides analytical support to the Interstitial Water Chemistry Project (grant number R805963, page 26) by performing chemical analyses on the pore water samples collected by the Maryland Geological Survey.

SCIENTIFIC APPROACH:

Interstitial water samples will be assayed for ion concentrations of chloride, nitrate, nitrite, phosphate, sulfate, sulfite, sodium, potassium, ammonium, calcium, magnesium, fluoride and hydrogen carbonate (alkalinity). Hydrogen carbonate is determined by an acid-base titration. All other ions are determined by ion chromatography.

PRODUCTS:

Concentrations of each of the 13 critical ions will be assembled into 10-member vertical profiles for the 100 sediment cores of the Interstitial Water Chemistry Project.

MONITORING PARTICLE-ASSOCIATED TOXIC SUBSTANCES AND SUSPENDED SEDIMENT IN THE CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):
Walter Taylor

PROJECT NUMBER:
R805959

PERFORMING ORGANIZATION:
The Johns Hopkins University
Chesapeake Bay Institute
4800 Atwell Road
Shady Side, MD 20867

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$119,592*
Performing Organization Share	6,294
TOTAL	$125,886

PROJECT PERIOD:
Begin - 7/25/78
End - 7/24/80

OBJECTIVES:

This project evaluates the role of suspended sediment on the budget of toxic substances in the Chesapeake Bay. There are four major study objectives: (1) to make a seasonal characterization (chemical, physical) of suspended sediment in the water column in the main portion of the Bay and in selected major tributaries, (2) to determine exchanges of particle-associated toxics between selected tributaries and the main body of the Bay for average conditions as well as for more extreme levels of river discharge, (3) to evaluate various models of transport for particle-associated toxics, and (4) to establish rates and patterns of movements and deposition of particle-associated toxics.

SCIENTIFIC APPROACH:

Monthly field surveys provide data on suspended sediment concentrations along the main axis of the Bay and at the mouths of major tributaries. Quarterly cruises survey exchanges of sediment between tributaries and main Bay as well as develop the relationships between suspended sediment and fluid mud (coordinated with the Virginia Institute of Marine Sciences' fluid mud project number R806002, page 29). Basic measurements include: suspended sediment concentration (optical, gravimetric), water temperature and salinity, dissolved oxygen, particle carbon and nitrogen, elemental composition of particulate matter, and chlorophyll-A concentrations.

PRODUCTS:

The project will result in an evaluation of suspended sediment as a transporting agent for toxics. It will also identify sources and sinks of toxics in various sediment types to aid quantification of the sediment budget.

* Represents 1st-year funding of a 2-year project.

FATE, TRANSPORT AND TRANSFORMATION OF TOXICS: SIGNIFICANCE OF SUSPENDED SEDIMENT AND FLUID MUD

PRINCIPAL INVESTIGATOR(s):
Maynard Nichols

PROJECT NUMBER:
R806002

PERFORMING ORGANIZATION:
Sedimentological Laboratory
Department of Geological Oceanography
Virginia Institute of Marine Science
Gloucester Point, VA 23062

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$197,879*
Performing Organization Share	10,403
TOTAL	$208,282

PROJECT PERIOD:
Begin - 9/01/78
End - 8/31/80

OBJECTIVES:

This study, which is a companion study of grant number R805959 (page 28), investigates the role of suspended sediment and fluid mud in the fate of toxic metals in the Chesapeake Bay system. Of primary interest are: (1) spatial and temporal patterns of toxic metals in suspended sediments, (2) preferential states of suspended sediment (i.e., clay, organic matter, etc.) for toxic metals, and (3) rates and routes of contaminant transport from source to sink.

SCIENTIFIC APPROACH:

A series of field observations will determine the Bay-wide distribution of metal contaminants over a seasonal cycle of changing sediment influx and saline mixing. Concentrations of selected metals are measured in the organic and inorganic fractions of suspended material through the water column and in near-bed fluid mud. Pertinent environmental measurements of salinity, pH, turbidity, and dissolved oxygen are also taken. Mobility of suspensions and contaminants at the mud/water interface are monitored over two tidal cycles.

PRODUCTS:

The study will produce an evaluation of the role of suspended sediments and fluid mud in transporting toxics allied to sources and sinks and will allow quantification of this portion of the sediment budget. The study will also establish a baseline for documenting future accumulations and depletions of toxic metals.

* Represents 1st-year funding of a 2-year project.

CHESAPEAKE BAY EARTH SCIENCE STUDY - ANIMAL SEDIMENT RELATIONSHIP

PRINCIPAL INVESTIGATOR(s):
Owen P. Bricker

PROJECT NUMBER:
R805964

PERFORMING ORGANIZATION:
Maryland Geological Survey
Chesapeake Bay Earth Science Study
The Johns Hopkins University
Baltimore, MD 21218

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$117,473
Performing Organization Share	46,653
TOTAL	$164,126

PROJECT PERIOD:
Begin - 8/01/78
End - 7/31/80

OBJECTIVES:

This study is concerned with the Maryland portion of the Bay and is coordinated with a similar study being conducted by the Virginia Institute of Marine Science (grant number R805982, page 31). This study investigates the relationship of benthic fauna to bottom sediments and seeks to infer the role of benthic fauna in augmenting the exchange of dissolved material across the sediment-water interface.

SCIENTIFIC APPROACH:

The Maryland portion of the Bay will be surveyed for principal physical and biogenic structures, sediments, benthic fauna, and characteristics of the overlying water column. Boxcore samples of bottom sediments will undergo a wide range of analyses (from standard chemical and physical tests to X-radiography). These analyses will: (1) define the diversity and abundance of the organisms, (2) relate specific animals to certain biogenic structures (burrows, tubes, etc.), and (3) provide physical and chemical information on the sediment.

PRODUCTS:

This study will provide a three-dimensional picture of the benthic environment which, when correlated with the results of the interstitial water projects, will provide a better picture of the role of benthic organisms in the exchange of toxic-laden material across the sediment-water interface.

THE BIOGENIC STRUCTURE OF CHESAPEAKE BAY SEDIMENTS

PRINCIPAL INVESTIGATOR(s):
Donald F. Boesch

PROJECT NUMBER:
R805982

PERFORMING ORGANIZATION:
Division of Biological Oceanography
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:

EPA Share	$ 76,587
Performing Organization Share	8,065
TOTAL	$ 84,652

PROJECT PERIOD:
Begin - 7/10/78
End - 7/09/80

OBJECTIVES:

This study is concerned with the Virginia portion of the Bay, and is coordinated with a similar project being conducted by the Maryland Geological Survey under grant number R805964 (page 30). This study investigates the relationships of benthic fauna to bottom sediments and infers the role of benthic fauna in augmenting the exchange of dissolved material across the sediment-water interface.

SCIENTIFIC APPROACH:

The Virginia portion of the Bay will be surveyed for principal physical and biogenic structure, sediments, benthic fauna, and characteristics of the overlying water column. Boxcore samples of bottom sediments will undergo a wide range of analyses (from standard physical and chemical tests to X-radiography). These analyses will: (1) define the diversity and abundance of the organisms, (2) relate specific animals to certain biogenic structures, and (3) provide physical and chemical information for the sediment.

PRODUCTS:

This study will provide a three-dimensional picture of the benthic environment of the Lower Bay which, when correlated with results of the interstitial water project, grant number R805964 (page 30), will provide a better picture of the role of benthic organisms in the exchange of toxic-laden material across the sediment-water interface.

INVESTIGATION OF THE CHESTER RIVER OYSTER MORTALITY

PRINCIPAL INVESTIGATOR(s):

Howard Wilson*
David Freeman
Joseph Cooney

PROJECT NUMBER:

R805976

PERFORMING ORGANIZATION:

Water Resources Administration
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401

EPA PROJECT OFFICER:

Lowell Bahner

BUDGET:

EPA Share	$ 83,750
Performing Organization Share	11,918
TOTAL	$ 95,668

PROJECT PERIOD:

Begin - 7/24/78
End - 7/23/79

OBJECTIVES:

This project seeks to identify the causes of oyster mortality in the Chester River.

SCIENTIFIC APPROACH:

The study is conducted in three concurrent parts: (1) Biotoxicity assays are conducted at each potential point discharge source for toxics. A 3-1/2-month field program arrays a test population of oysters in the Chester River; the test population is periodically compared to a control population. A more detailed study employs direct exposure of crayfish and finfish to effluents from suspected toxic discharge sources over a 96-hour period. Patterns of morbidity and mortality are then used to locate effluents potentially responsible for oyster mortality in the estuary. (2) Chester River water, sediment, and shellfish are assayed, combining gas liquid chromatography with mass spectrometric detection. (3) The role of tin (organic as well as inorganic) as a contributor to oyster mortality is investigated by analyzing water, sediment, and oyster tissues. Each sample is examined for tin by atomic absorption spectrometry, for total viable aerobic bacteria, for tin-resistant aerobic bacteria, and for ability to form organic tin compounds. Bacterial cultures are analyzed for total organo tin compounds using atomic absorption techniques.

PRODUCTS:

This study will attempt to locate and identify the agents causing the anomalous oyster mortality and to develop control strategies to correct the situation if appropriate.

* Project Manager.

INVENTORY AND TOXICITY PRIORITIZATION OF INDUSTRIAL FACILITIES DISCHARGING INTO THE CHESAPEAKE BAY BASIN

PRINCIPAL INVESTIGATOR(s):
Thomas Hopper

PROJECT NUMBER:
68-02-2607

PERFORMING ORGANIZATION:
GCA Corporation/Technology Division
Burlington Road
Bedford, Massachusetts 01730

EPA PROJECT OFFICER:
Donald Francisco

BUDGET:
EPA Share .....$ 83,356
TOTAL.....$ 83,356

PROJECT PERIOD:
Begin - 03/28/79
End - 09/30/79

OBJECTIVES:

The objective of this project is to identify industrial discharges of toxic chemical effluents in the Chesapeake Bay Basin. A point source assessment will be performed in order to determine the amount of wastewater effluent discharged, and the identity and concentration of possible toxic materials in respective effluent streams.

Both major and minor dischargers will be identified with respect to industrial and chemical factors.

SCIENTIFIC APPROACH:

Industrial discharges into the Chesapeake Bay Basin in the states of Virginia and Maryland will be studied. Each discharger will be identified by NPDES permit number, location, basin, SIC code, discharge rate and mode of discharge either direct or via a POTW.

A chemical inventory will be made of major dischargers located within the fall line of the Chesapeake Bay.

PRODUCTS:

A priority list of discharges will be developed. An inventory of constituents of each major effluent will be compiled in hardcopy and computer magnetic tapes.

SUBMERGED AQUATIC VEGETATION PROGRAM AREA

Submerged Aquatic Vegetation (SAV) occupies an important position in the ecology of the Chesapeake Bay system. SAV provides food, shelter, habitat and breeding areas for finfish, shellfish, waterfowl and species of the lower trophic levels. SAV beds act as sediment traps and wave breakers that serve to improve bottom stability, reduce turbidity and retard shoreline erosion. In recent years there has been a sharp decline in the abundance of SAV in the Bay system; this has caused alarm because it seems to correlate with the overall ecological health of the Bay and may be an indicator of significant environmental damage to the Bay system.

A management plan for SAV must await a clear definition of the cause-and-effect relationships that bear upon the problem. To this end, the Chesapeake Bay Program is addressing the impact of water quality factors upon SAV and those living resources known or suspected to be dependent upon SAV. Study products will identify, and where possible quantify, important ecosystem functions that SAV performs in the Bay system. These results will provide the knowledge base from which water quality management alternatives will be developed for the enhancement of SAV and associated living resources.

SUBMERGED AQUATIC VEGETATION PROJECTS

DISTRIBUTION OF SUBMERGED VASCULAR PLANTS IN THE CHESAPEAKE BAY, MARYLAND - 1978

PRINCIPAL INVESTIGATOR(s):
Richard R. Anderson

PERFORMING ORGANIZATION:
Department of Biology
The American University
Washington, D.C. 20016

PROJECT NUMBER:
R805977

EPA PROJECT OFFICER:
William Cook

BUDGET:

EPA Share	$137,397
Performing Organization Share	9,022
TOTAL	$146,419

PROJECT PERIOD:
Begin - 6/01/78
End - 1/31/80

OBJECTIVES:

This study, a companion project of grant number R805951 (page 36), seeks to (1) establish an inventory of SAV distribution and species concentration in Maryland waters, and (2) assess the usefulness of archival aerial photography for estimating trends in distribution and abundance in the Bay.

SCIENTIFIC APPROACH:

Aerial photography and photointerpretation are utilized to establish a data baseline. Photographs of the submerged aquatic vegetation are taken to match the United States Geological Survey's quad sheet scale of 1:24,000 and quality control is assured by consideration of the following factors: (1) SAV growing season, (2) turbidity, (3) atmospheric haze, (4) wind conditions, (5) sun angle, and (6) tide stage. Field samples are collected to provide ground truth verification of the photointerpretation process.

PRODUCTS:

Study products include: (1) a current inventory of SAV in Maryland waters in the form of maps showing distribution of SAV with species annotation, and (2) an assessment of trends in SAV populations in selected areas where usable historic photography is available.

DISTRIBUTION AND ABUNDANCE OF
SAV IN THE LOWER CHESAPEAKE BAY, VIRGINIA - 1978

PRINCIPAL INVESTIGATOR(s):
Robert J. Orth

PROJECT NUMBER:
R805951

PERFORMING ORGANIZATION:
Department of Invertebrate Ecology
Virginia Institute of Marine Science
Gloucester Point, VA 23062

EPA PROJECT OFFICER:
William Cook

BUDGET:

EPA Share	$68,681
Performing Organization Share	4,066
TOTAL	$72,747

PROJECT PERIOD:
Begin - 6/01/78
End - 8/15/79

OBJECTIVES:

There are three project objectives: (1) to map the present distribution of SAV beds in the saline portions of the Bay in Virginia, (2) to determine changes in SAV distribution in parts of the Lower Bay over a 40-year period, and (3) to map SAV distribution in selected freshwater portions of the subestuaries. A companion study (grant number R8055977, page 35) is being conducted by The American University.

SCIENTIFIC APPROACH:

Mapping of present distributions is performed from aerial photography of all SAV beds in the saline Lower Bay at a scale of 1:24,000. A single demonstration study of freshwater species of SAV in selected turbid freshwater portions of the subestuaries is included. Species differentiations and environmental conditions are verified through surface examinations of representative SAV beds utilizing skindiving observations on selected transects. Historical aerial photography for a maximum of six saline areas and possible freshwater areas, obtained for years from 1937 to 1977, is compared with the new photography to assess trends.

PRODUCTS:

Products include a report and a series of maps of the Lower Chesapeake Bay showing: (1) present distribution and abundance of SAV, (2) acres of SAV in the Lower Chesapeake Bay, and (3) trends of historical SAV changes in selected areas.

DISTRIBUTION AND ABUNDANCE OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHESAPEAKE BAY - 1979

PRINCIPAL INVESTIGATOR(s):
Robert J. Orth

PROJECT NUMBER:
X-003201-01

PERFORMING ORGANIZATION:
Department of Invertebrate Ecology
Virginia Institute of Marine Science
Gloucester Point, VA 23062

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$18,436*
Performing Organization Share	1,214
TOTAL	$19,650

PROJECT PERIOD:
Begin - 6/01/79
End - 5/31/81

OBJECTIVES:

This project continues the research of grant number R805951 (page 36) and will: (1) identify those areas in the Lower Chesapeake Bay that contain stands of SAV with emphasis on the saline regions, (2) obtain high-quality aerial imagery of those areas that contain significant SAV, (3) delineate SAV species type and distribution in areas which have dense SAV, and (4) determine if significant alterations have occurred in comparison to the similar study conducted in 1978. This work is similar to work performed by the Chesapeake Bay Foundation (grant number X-00-3202-01, page 38) for the Maryland portion of the Bay.

SCIENTIFIC APPROACH:

The survey will be conducted in two phases. The initial phase will survey the Lower Bay to identify areas containing SAV. Areas with significant coverage (greater than 10 percent) will be noted for inclusion in the second stage. The second stage will photograph the SAV in the significant zones at an image scale of 1:24,000. Corroborative surface missions will be conducted in areas shown to have SAV coverage in excess of 40 percent. Species present, abundance, sediment type, and salinity will be recorded. Representative specimens will be submitted to the National Herbarium for confirmation of species. Data will be mapped on USGS topographic quadrangles, and the area of SAV beds computed. The 1979 data will be compared to data collected in 1978 to identify changes in SAV distribution and will aid in the design of the 1980 distribution and abundance project.

PRODUCTS:

Study products include maps of SAV for 1979 with supporting documentation and changes in SAV that have occurred between 1978 and 1979.

* Represents 1st-year funding of a 2-year project.

DISTRIBUTION OF SUBMERSED AQUATIC VEGETATION
IN CHESAPEAKE BAY, MARYLAND - 1979

PRINCIPAL INVESTIGATOR(s):
Robert J. Macomber

PROJECT NUMBER:
X-003202-01

PERFORMING ORGANIZATION:
Chesapeake Bay Foundation
"The Church"
Prince George & East Streets
Box 1704
Annapolis, MD 21404

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$56,430*
Performing Organization Share	2,970
TOTAL	$59,400

PROJECT PERIOD:
Begin - 6/15/79
End - 4/15/81

OBJECTIVES:

This study largely continues the activities of grant number R805977 (page 35). The two project objectives are: (1) to establish a 1979 inventory of SAV distribution and species concentration in Maryland waters, and (2) to compare 1979 with 1978 SAV inventory for identification of gross change in SAV distribution and abundance. The companion study to this project is grant number X-003201-01 (page 37).

SCIENTIFIC APPROACH:

Aerial reconnaissance will be conducted to identify areas that are significantly vegetated. Photographs will be taken of significantly vegetated areas at a scale of 1:24,000. SAV distribution and abundance maps will be developed for areas showing significant change from the 1978 inventory. Quality control will be assured by consideration of the following factors: (1) SAV growing season, (2) turbidity, (3) atmospheric haze, (4) wind conditions, (5) sun angle, and (6) tide. Field samples will be collected to provide ground verification of the photointerpretation process. The results of this inventory and subsequent comparison with the 1978 study will assist in designing the 1980 distribution and abundance project.

PRODUCTS:

Project results will include: (1) a current inventory of SAV in Maryland waters in the form of maps with species annotation, of areas showing significant distribution changes of SAV since 1978, and (2) an estimate of trends in SAV populations from 1978 to 1979.

* Represents 1st-year funding of a 2-year program.

BIOSTRATIGRAPHY OF THE CHESAPEAKE BAY: A FEASIBILITY STUDY

PRINCIPAL INVESTIGATOR(s):
Grace S. Brush

PROJECT NUMBER:
R805962

PERFORMING ORGANIZATION:
Department of Geography &
Environmental Engineering
The Johns Hopkins University
34th and Charles Streets
Baltimore, MD 21218

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$134,675
Performing Organization Share	7,088
TOTAL	$141,763

PROJECT PERIOD:
Begin - 07/01/78
End - 10/31/79

OBJECTIVES:

The project investigates the feasibility of obtaining scientific information for Chesapeake Bay management from stratigraphic analysis of sediments. Changes in SAV populations, eutrophication, and sedimentation rates are defined over past time periods of a few hundred years or more and correlated with natural events and human activity.

SCIENTIFIC APPROACH:

Core samples of Bay sediments, 5 centimeters in diameter and up to 2 meters in length, are collected from undisturbed locations in three parts of the Bay; Susquehanna flats and Furnace Bay in the Upper Bay, Eastern Bay in the mid-Bay region, and Hungar's Creek on the Eastern Shore at the Lower Bay. The cores are examined to determine the most appropriate fossil indicators of SAV and eutrophication. Cores are split for analyses which will provide for extraction of SAV fossils, and for analyses for total organic carbon, sedimentary chlorophyll, pollen and diatoms. Cores taken from the Bay proper are split and analyzed by pollen and Pb_{210} to compare the dating methods. Historical and meteorological dates are compiled for correlation with data obtained from the core analyses. The present study is considered to be a feasibility study for a more detailed program, grant number R806680 (page 40). The effort also includes the design of a statistically reliable sampling procedure for further work.

PRODUCTS:

Results of the project include vertical profile descriptions of SAV populations, biomass and sedimentation rates for the period of time covered by the extracted cores. There will be a report describing methodologies and correlating the data on long-term changes in SAV, eutrophication and sedimentation rates to natural events (such as hurricanes) and to man's impact on the Bay during these periods.

BIOSTRATIGRAPHY OF THE CHESAPEAKE BAY AND ITS TRIBUTARIES

PRINCIPAL INVESTIGATOR(s):
Grace S. Brush

PERFORMING ORGANIZATION:
Department of Geography &
Environmental Engineering
The Johns Hopkins University
34th and Charles Streets
Baltimore, MD 21218

PROJECT NUMBER:
R806680

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:
EPA Share.....$ 99,285
Performing Organization
Share..... 5,225
TOTAL.....$104,510

PROJECT PERIOD:
Begin - 11/01/79
End - 08/31/81

OBJECTIVES:

This project expands the work done by the feasibility study conducted under grant number R805962 (page 39). The project will study the natural cycles of SAV and diatom populations over several hundred years, and correlate deviations from these cycles resulting from human impacts or natural events. Sedimentation rates will be studied and relationships to the natural events and land use changes will be established.

SCIENTIFIC APPROACH:

Core samples of Bay sediments, 5 centimeters in diameter and up to 2 meters in length, collected from undisturbed locations in four areas of the Bay are to be examined for fossil indicators of SAV and eutrophication. The cores are split for analysis of SAV fossils, total organic carbon, pollen and diatoms. Historical and meteorological data are to be compiled for correlation with core data. Bay sediment samples will be collected from the Patuxent and Choptank subestuaries in the Upper Bay, and the York and Ware subestuaries in the Lower Bay. Additional long cores ($\sim$12 m) will be analyzed from two locations - one in the Upper Bay and one in the Lower Bay - to compare changes in pre- and postsettlement core sections.

PRODUCTS:

There will be a report describing methodologies and relating the data on long-term changes in SAV, eutrophication and sedimentation rates to natural events and to man's impact on the Bay during these periods. Data will be computerized showing vertical profile descriptions of SAV populations, eutrophication and sedimentation rates for the time periods covered by the extracted cores.

ZOSTERA MARINA:
BIOLOGY, PROPAGATION AND IMPACT OF HERBICIDES

PRINCIPAL INVESTIGATOR(s):
Robert J. Orth

PROJECT NUMBER:
R805953

PERFORMING ORGANIZATION:
Department of Invertebrate Ecology
Virginia Institute of Marine Science
Gloucester Point, Virginia 23062

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$321,815
Performing Organization Share	41,699
TOTAL	$363,514

PROJECT PERIOD:
Begin - 7/17/78
End - 1/15/81

OBJECTIVES:

This project is aimed at developing a technology for establishing and propagating eelgrass (Zostera marina) and for determining the impact of herbicides on the grass. A subobjective is the definition of biological and cultural factors affecting eelgrass propagation.

SCIENTIFIC APPROACH:

Research into the biology and propagation of eelgrass is conducted through field studies and sampling of beds on the eastern and western shore of the Lower Bay, including biomass measurements and in-situ seed germination experiments. Laboratory, greenhouse and field studies are made to determine optimal procedures for storing and germinating seeds, culturing seedlings and transplanting seedlings and wild plants. The effects of herbicides on eelgrass are studied through field investigations of herbicide (atrazine in particular) levels in selected Virginia Bay eelgrass areas, especially during and after storm surges. There will be an investigation of controlled dosing of eelgrass beds with herbicides in specially constructed enclosures. Relations between herbicide loadings and natural suspended sediments are also investigated. Sublethal effects of herbicides will be investigated at the physiological level.

PRODUCTS:

The project will result in a set of computer-stored data, compatible with other SAV data in the Chesapeake Bay Program. A report will be prepared containing a thorough discussion of methodologies, project results and the implications of the results for the Bay ecosystem.

SUBMERGED AQUATIC VEGETATION IN THE CHESAPEAKE BAY: ITS ROLE IN THE BAY ECOSYSTEM AND FACTORS LEADING TO ITS DECLINE

PRINCIPAL INVESTIGATOR(s):
J. Court Stevenson
W. M. Kemp
W. R. Boynton

PROJECT NUMBER:
R805932

PERFORMING ORGANIZATION:
University of Maryland
Center for Environmental and Estuarine Studies
Horn Point Environmental Laboratories
P.O. Box 775
Cambridge, MD 21613

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$639,311
Performing Organization Share	170,371
TOTAL	$809,682

PROJECT PERIOD:
Begin - 07/15/78
End - 12/14/80

OBJECTIVES:

Project objectives are: (1) to identify toxicity and stress levels of herbicides, turbidity and their synergistic effects on SAV, (2) to examine critical pathways and mechanisms of herbicides and turbidity in relation to SAV, (3) to identify the ecological function of SAV, (4) to evaluate economic and energetic costs and benefits of various watershead practices, (5) to develop nutrient, sediment and herbicide budgets for the Patuxent and Choptank subestuaries, and (6) to evaluate management options for controlling causative factors in the decline of SAV.

SCIENTIFIC APPROACH:

This project proceeds from microscale to macroscale studies at four levels: (1) microcosmic laboratory studies of impacts of turbidity, herbicides and nutrients on SAV, (2) similar studies in eight specially constructed 1/8-acre ponds, (3) field sample collection and investigation of SAV-environment relations of representative Bay sites, and (4) regional studies to investigate land use/pollutant interactions, simulating them mathematically in a model of the environmetal decisionmaking process. The hierarchical approach of this project allows for collection and interpretation of data and testing of hypotheses in situations of increasing realism and increasing complexity.

PRODUCTS:

The project will attempt to: (1) determine the factors leading to the decline of SAV in the Bay, (2) describe the dependence of commercially valuable Bay animal species upon SAV, and (3) result in an ecological model of SAV that accounts for changes in its distribution and abundance in the Bay. SAV management options will be evaluated, based upon watershed utilization practices in the Choptank and Patuxent subestuaries.

THE FUNCTIONAL ECOLOGY OF SUBMERGED AQUATIC VEGETATION IN THE LOWER CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):

Richard L. Wetzel
Donald F. Boesch
Robert J. Orth
Kenneth L. Webb
John V. Merriner

PROJECT NUMBER:

R805974

PERFORMING ORGANIZATION:

Virginia Institute of Marine Science
Gloucester Point, VA 23062

EPA PROJECT OFFICER:

Thomas Nugent

BUDGET:

EPA Share	$649,409
Performing Organization Share	74,533
TOTAL	$723,942

PROJECT PERIOD:

Begin - 07/01/78
End - 12/31/80

OBJECTIVES:

This project will qualitatively and quantitatively investigate the functional ecological relationships in submerged seagrass communities in the Lower Chesapeake Bay. The resulting data and experimental approaches should: (1) enhance basic understanding, and (2) establish criteria for environmental assessment.

SCIENTIFIC APPROACH:

The project is divided into 4 subgroups. These subgroups are: (1) productivity, nutrient cycling and associated microbial metabolic activity in eelgrass communitites, (2) interaction involving resident consumers, (3) higher level consumer interactions, and (4) ecosystem modeling. The approach is experimentally oriented to quantify and describe processes that determine overall biotic community behavior. The research will use a team approach concentrating on a single site for intensive study. The resulting collection of studies will generate data to assist in designing simulation studies. These, in turn, will be used to evaluate specific interactions in relation to overall system dynamics.

PRODUCTS:

Anticipated products include: (1) quantification of the relative resource value of SAV habitats, (2) knowledge of how SAV communities interact with the entire Bay ecosystem, (3) determination of the use of SAV habitats by fish and wildlife of importance to man, (4) understanding of the life-support processes which underlie the resource values, and (5) understanding of the effects of loss of SAV habitats on Bay resources.

A final report will also include a detailed description in tabular and graphic form of: (1) conceptual and simulation model versions, (2) data requirements and output characteristics as well as sensitivity analysis of each version, and (3) identification of controlling or governing parameters and perturbation studies.

STUDIES ON THE VALUE OF VEGETATED HABITATS AND THEIR ROLES AS NURSERY AREAS AND SHELTER FROM PREDATION WITH EMPHASIS ON UTILIZATION BY COMMERCIALLY EXPLOITED SPECIES

PRINCIPAL INVESTIGATOR(s):
Kenneth L. Heck, Jr.

PERFORMING ORGANIZATION:
Academy of Natural Sciences of Philadelphia
Benedict Estuarine Research Laboratory
Benedict, MD 20612

PROJECT NUMBER:
R806151

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$48,726
Performing Organization Share	2,565
TOTAL	$51,291

PROJECT PERIOD:
Begin - 08/01/78
End - 12/31/80

OBJECTIVES:

This project seeks to test the hypothesis that beds of SAV (1) contain significantly larger number of invertebrates than adjacent unvegetated areas, (2) harbor significantly greater concentrations of juveniles of commercially valuable fishes and grass shrimp, and (3) serve as shelters for juvenile fishes and grass shrimp where predator efficiency is lower than in unvegetated areas.

SCIENTIFIC APPROACH:

The approach is divided into two categories: (1) repetitive day and night field sampling of vegetated and nonvegetated sites and (2) laboratory tank experiments using known numbers of grass shrimp and a predator in SAV planted in bare sand (control) tanks.

Sampling locations and nearby control sites have been established in a high salinity Zostera marina meadow near the mouth of the York River in Virginia and in a lower salinity Ruppia maritima meadow near Parson's Island, Maryland. Day and night trawls have been taken in the Maryland and Virginia test and control sites.

The laboratory experiment utilizes two large (236 gallon) tanks to establish predator efficiency. An additional series of identical experiments will be carried out using artificial SAV to determine whether nonliving sources may provide protection for grass shrimp.

PRODUCTS:

The products will include data and graphs of abundance, species richness and size-frequency distributions at each of the sampling sites. Estimates of the degree of protection from predation provided by different densities and species of SAV will also be developed.

ASSESSMENT OF THE POTENTIAL IMPACT OF INDUSTRIAL EFFLUENTS ON SUBMERGED AQUATIC VEGETATION

PRINCIPAL INVESTIGATOR(s):
Gerald E. Walsh

PROJECT NUMBER:
In-house

PERFORMING ORGANIZATION:
U.S. Environmental Protection Agency
Environmental Research Laboratory
Gulf Breeze, Florida 32561

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:
EPA Share $140,027
TOTAL $140,027

PROJECT PERIOD:
Begin - 7/10/78
End - 7/09/79

OBJECTIVES:

This project assesses the potential impact of industrial effluents and the combination of industrial effluents and herbicides on SAV. Since little is known about the toxicity of industrial wastes to marine organisms, the study is to determine for selected effluents, what fraction, organic or inorganic, contains the toxic factor.

SCIENTIFIC APPROACH:

Waste samples collected in the Bay were shipped by air and received at the Gulf Breeze Laboratory the same day. Tests were begun immediately for chemical and biological assays. Complex waste samples were passed through an XAD resin column to remove dissolved organic matter. The purged, inorganic fraction was then subfractioned into heavy and nonheavy metal portions using Dowex strongly basic anion and cation exchange resins. Bioassays were subfractionated into compounds extractable with acetone under acidic, basic and neutral conditions.

Test species were: Zostera marina, Thalassia testudinum, and Skeletonema costatum. SAV's were exposed to the toxicants in a 4-liter reaction kettle fitted with a false bottom. Seagrass planted in sand in the kettles were then observed after exposure to waste concentrations of 25, 50, 75 and 100 percent.

PRODUCTS:

The project produces empirical data which will be useful in assessing the impact of effluents on SAV.

EFFECTS OF RECREATIONAL BOATING ON TURBIDITY AND SEDIMENTATION RATES IN RELATIONSHIP TO SUBMERGED AQUATIC VEGETATION

PRINCIPAL INVESTIGATOR(s):
Jerome Williams
Hermann Gucinski

PROJECT NUMBER:
EPA-78-D-X0426
Interagency Agreement

PERFORMING ORGANIZATION:
Department of Oceanography
U.S. Naval Academy
Annapolis, Maryland 21402

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:
EPA Share $28,613
TOTAL $28,613

PROJECT PERIOD:
Begin - 07/01/78
End - 10/30/79

OBJECTIVES:

This project has two primary objectives: (1) to determine if small-craft-induced water turbulence leads to measurable increases in suspended sediment and to determine the preferred measurement techniques, and (2) to determine the effects of recreational boating on suspended sediments.

SCIENTIFIC APPROACH:

Sediment resuspension due to small craft induced water motion was measured by: (1) gravitation analysis of suspended sediment, (2) light extinction as measured by photometer and (3) light scattering as measured by transmissiomter. Effects due to vessel passage were compared to values obtained prior to vessel passes at several locations, primarily on the Rhode River, Upper Chesapeake Bay, and chosen to allow changing one variable at a time. Variables include water depth, sediment type, and boar type.

Laboratory measurements were made to determine average velocity and turbulence intensity due to propeller effects alone, and results will allow an estimate of the Reynold's stress. This stress, when combined with data on critical stresses for sediment resuspension, may allow prediction of the stress distribution as a function of depth and propeller immersion. Measurements were made using open channel flume, a laser-Doppler anemometer, and Fourier analyzer.

Recreational boating effects on suspended sediments were determined by comparison of controlled and uncontrolled shallow estuarine environments. Water transparency was measured by: (1) gravimetric determination of suspended solids, (2) determination of beam transmittance, and (3) use of the Sechi Disc.

PRODUCTS:

The products include data correlating the effects of small craft passage, recreational boating (waterskiing), weather, and tidal current on suspended sediment, as well as the subsequent effect of suspended sediment on SAV.

FACTORS AFFECTING AND IMPORTANCE OF SUBMERGED
AQUATIC VEGETATION IN CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):
Fant Martin*
Walter Valentine

PROJECT NUMBER:
EPA-78-D-X0391
Interagency Agreement

PERFORMING ORGANIZATION:
Migration Bird and Habitat
Research Laboratory
U.S. Fish and Wildlife Service
Laurel, MD 20811

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:
EPA Share.....$228,372
TOTAL $228,372

PROJECT PERIOD:
Begin - 8/01/78
End - 9/30/80

OBJECTIVES:

The project will (1) determine the relationship of SAV to migratory waterfowl in the Bay, and (2) prepare a synthesis of data on SAV and intepret the role of SAV in the Bay ecosystem.

SCIENTIFIC APPROACH:

Historic data on migratory waterfowl habitat and feeding patterns will be compiled. Current distribution and feeding patterns will be evaluated through aerial surveys and surface verification. The approach for the second objective will involve a variety of graphical and statistical analyses of data collected by CBP/SAV researchers, detailed discussions of research results, and comparisons of these results with current and past research done outside the CBP.

PRODUCTS:

The project will result in: (1) an analysis of the historic and present correlations between migratory waterfowl and SAV, (2) a synthesis, integration and interpretation of the results of all the SAV projects, including: a detailed description of the structure and dynamics of SAV-based ecosystems; the ecological and economic importance of SAV; trends in the distribution and abundance of SAV in space and time; likely causes of declines in SAV distribution and abundance and the conditions conducive to growth of SAV; management implications of the research findings.

* Project Manager.

EUTROPHICATION PROGRAM AREA

The process of nutrient enrichment, frequently called eutrophication, was first used to describe an advanced state in a natural process of aging and succession in freshwater lakes. Eutrophic means "well nourished" or enriched in dissolved nutrients and generally implies high productivity as well. Excessive enrichment occurs when the resulting aquatic conditions preclude some potential use, thereby having undesirable consequences. Such an excess can arise from either natural or cultural causes. Enrichment in estuaries can have both subtle and gross effects which are distinctly different from those which occur in freshwater systems.

The undesirable effects of eutrophication in an estuarine environment are much better understood than the possible desirable effects. It is amply documented that reduced levels of dissolved oxygen have occurred in the Upper Bay and its headwaters. It is also well known that undesirable algal species have started to displace desirable species which serve as food for higher organisms in some of the Bay's principal tributaries. However, little is known about the contribution of nutrient enrichment to possibly higher yields of finfish and shellfish and other products derived by man from the Chesapeake Bay system.

Even if it were possible to assume that the undesirable effects of eutrophication by far outweigh its contribution, the program is still faced with the problem of devising cost-effective control strategies for nutrients.

This however requires a thorough understanding of nutrient sources, particularly quantification of the relative contribution of point and nonpoint sources.

This program is designed to take a new look at the eutrophication question and to assure that eutrophication does not interfere with a maximization of beneficial uses of the Chesapeake Bay system. Presumably, if eutrophication is controlled, society will receive some possible long-range benefit. A higher level of nutrient control should result in more benefits; however, higher control levels have greater costs. The costs to implement the particular control strategy should be justified by the benefits derived from reducing the eutrophication level.

DEFINITION OF CHESAPEAKE BAY PROBLEMS OF EXCESSIVE ENRICHMENT OR EUTROPHICATION

PRINCIPAL INVESTIGATOR(s):

L. Eugene Cronin* Donald Heinle
Bruce Nielson Kenneth Webb
Andrew McErlean Jay Taft

PROJECT NUMBER:

R806189

PERFORMING ORGANIZATION:

Chesapeake Research Corporation
1419 Forest Drive
Suite 207
Annapolis, MD 21403

EPA PROJECT OFFICER:

Thomas Pheiffer

BUDGET:

EPA Share.....$360,411
Performing Organization
Share..... 23,921
TOTAL.....$384,332

PROJECT PERIOD:

Begin - 10/16/78
End - 10/15/80

OBJECTIVES:

The objectives of this program are: (1) to provide a summary of the fundamentals of nutrient enrichment as related to the Chesapeake Bay specifically and estuaries in general, (2) to describe nutrient enrichment of the Bay from a historical as well as contemporary perspective, (3) to apply and improve existing indicators and indices for nutrient enrichment for the Bay, (4) to explore and express the relationships between the nutrient enrichment and the consequences in the ecosystem as well as to Bay users, and (5) to define the related needs for future research and monitoring of conditions in the Chesapeake Bay.

SCIENTIFIC APPROACH:

The project workplan calls for an extensive literature survey, a thorough examination of historical data, and a critical evaluation of indexing approaches. A March 1979, workshop, followed by the "International Symposium on the Effects of Nutrient Enrichment in Estuaries" (May 1979), will serve to develop a primary reference document on the subject.

PRODUCTS:

The products of this study include a concise definition of the process of eutrophication in the estuarine environment and a "Status of the Bay" report giving both historical and present eutrophication trends. Data gaps, research needs and monitoring requirements will be identified.

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* Project Manager.

AN ASSESSMENT OF NONPOINT SOURCE DISCHARGE, PEQUEA CREEK BASIN, LANCASTER COUNTY, PENNSYLVANIA

PRINCIPAL INVESTIGATOR(s):
Robert J. Bielo*
Janice Ward

PROJECT NUMBER:
X-003146-01
X-003146-02

PERFORMING ORGANIZATION:
Susquehanna River Basin Commission
1721 North Front Street
Harrisburg, PA 17102

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:

EPA Share	(1st year)	$ 35,000
	(2nd year)	156,002
Performing Organization Share	(1st year)	5,000
	(2nd year)	8,211
TOTAL		$204,213

PROJECT PERIOD:
Begin - 10/01/77
End - 03/31/81

OBJECTIVES:

The project includes detailed investigations of sediment, nutrient, and pesticide loadings in the surface waters of the Pequea Creek Basin. The project is one of four evaluating five watersheds in Maryland, Virginia and Pennsylvania. Emphasis will be on obtaining runoff rates from the various land use categories in this Basin, a high yielding agricultural area of the lower Susquehanna River.

SCIENTIFIC APPROACH:

The established pattern of data collection in the study area is to be continued. The automated sampling station at the downstream limit of the study area from the previous year will be retained. Five new automated stations will be established in small areas of single land uses representative of the lower Susquehanna River Basin. Samples will be collected during all storm runoff periods at all six stations. Four storms during the year will be manually sampled in conjunction with automatic sampling to define changes in concentrations of constituents with the rise and fall of the stream during storms. Periodic baseflow, precipitation and soil samples will also be collected.

PRODUCTS:

This project will provide further field verification information about links between agricultural practice and resulting sediment-nurient-pesticide loading of surface water courses. This information will aid in assessing the contribution of nonpoint source discharges of these materials from the lower Susquehanna River Basin to the Bay system.

* Project Manager.

EVALUATION OF WATER QUALITY MANGEMENT TOOLS
IN THE CHESTER RIVER BASIN

PRINCIPAL INVESTIGATOR(s):
Howard Wilson*

PROJECT NUMBER:
R806343

PERFORMING ORGANIZATION:
Water Resources Administration
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:

EPA Share	$543,340
Performing Organization Share	64,208
TOTAL	$607,548

PROJECT PERIOD:
Begin - 10/16/78
End - 10/15/81

OBJECTIVES:

The project seeks to evaluate available tools for predicting eutrophication in estuarine systems. It is one of four projects, evaluating five watersheds in Maryland, Pennsylvania and Virginia; the Chester River Basin is the subject of this research.

SCIENTIFIC APPROACH:

The four tasks in the research plan are: (1) to evaluate existing and proposed data collection efforts with respect to known water quality problems and management alternatives for the basin, (2) to construct a data base of sufficient detail to be used with the most data intensive models to be evaluated, (3) to select a set of management tools and apply them to the test basin, and (4) to evaluate the tested models both with respect to management applications in the test basin, as well as transferability to other Chesapeake Bay watersheds.

PRODUCTS:

This project will assess a range of management tools for cost-effectiveness and accuracy in predicting the loadings, transport and fate of nutrients from nonpoint sources of nutrients. The techniques assessed may be applied to geographical areas to estimate the extent of nonpoint sources which could be expected under various runoff conditions.

* Project Manager.

INTENSIVE WATERSHED STUDY (PATUXENT RIVER BASIN)

PRINCIPAL INVESTIGATOR(s):

Howard Wilson*

PROJECT NUMBER:

R806306

PERFORMING ORGANIZATION:

Water Resources Administration
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401

EPA PROJECT OFFICER:

Thomas Pheiffer

BUDGET:

EPA Share	$452,340
Performing Organization Share	67,806
TOTAL	$520,146

PROJECT PERIOD:

Begin - 10/16/78
End - 10/15/80

OBJECTIVES:

This study is one of four projects, evaluating five watersheds in Maryland, Pennsylvania and Virginia; the Patuxent River Basin is the subject of this research. The project seeks to evaluate available tools for predicting eutrophication by comparing costs and estimating the accuracy of the models.

SCIENTIFIC APPROACH:

There are four tasks in the research plan: (1) to evaluate existing and proposed data collection efforts with respect to known water quality problems and mangement alternatives for the basin, (2) to construct a data base of sufficient detail to be used in connection with the most data-intensive models to be evaluated, (3) to select a set of management tools and apply them to the test basin, and (4) to evaluate the tested models both with respect to management applications in the test basin, as well as transferability to other Chesapeake Bay watersheds.

PRODUCTS:

This project will assess a range of management tools aimed at their cost-effectiveness and accuracy in predicting the loadings, transport and fate of nonpoint sources of nutrients. The techniques assessed may be applied to geographical areas to estimate the extent of nonpoint sources which could be expected under various runoff conditions.

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* Project Manager.

EVALUATION OF MANAGEMENT TOOLS IN TWO
CHESAPEAKE BAY WATERSHEDS IN VIRGINIA

PRINCIPAL INVESTIGATOR(s):
Robert V. Davis*
Thomas Grizzard
Bruce Nielson

PROJECT NUMBER:
R806310

PERFORMING ORGANIZATION:
Virginia State Water Control Board
2111 N. Hampton Street
Richmond, VA 23230

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:

EPA Share	$ 999,240
Performing Organization Share	110,033
TOTAL	$1,109,273

PROJECT PERIOD:
Begin - 10/01/78
End - 09/30/80

OBJECTIVES:

This study is one of four projects, evaluating five watersheds in Maryland, Pennsylvania and Virginia; the Occoquan and Ware River Basins in Virginia are the subject of this research. The project seeks to evaluate available tools for predicting eutrophication by comparing costs and estimating the accuracy of the models.

SCIENTIFIC APPROACH:

Four tasks will be completed. The project will: (1) evaluate existing and proposed data collection efforts with respect to known water quality problems and management alternatives for the basin, (2) construct a data base of sufficient detail to be used with the most data-intensive models to be evaluated, (3) select a set of management tools and apply them to the test basin, and (4) evaluate the tested models both with respect to management applications in the test basin, as well as transferability to other Chesapeake Bay watersheds.

PRODUCTS:

This project like the studies in Maryland and Pennsylvania will assess a range of management tools aimed at their cost-effectiveness and accuracy in predicting the loadings, transport and fate of nonpoint sources of nutrients. The techniques assessed may be applied to geographical areas to estimate the extent of nonpoint sources which could be expected under various runoff conditions.

* Project Manager

MODELING PHILOSOPHY AND APPROACH FOR
CHESAPEAKE BAY PROGRAM
WATERSHED STUDIES

PRINCIPAL INVESTIGATOR(s):
Robert Ambrose

PROJECT NUMBER:
In-house

PERFORMING ORGANIZATION:
U.S. Environmental Protection Agency
College Station Road
Athens, GA 30601

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:
EPA Share $50,431
TOTAL $50,431*

PROJECT PERIOD:
Begin - 04/01/79
End - 10/01/81

OBJECTIVES:

Utilizing the field data collected in the watershed studies in Maryland, Pennsylvania and Virginia, this study seeks to (1) evaluate the relative effectiveness and basic accuracy of existing computer models as tools for the management of eutrophication in subestuaries of Chesapeake Bay and (2) provide information on the most cost-effective combination of models tested.

SCIENTIFIC APPROACH:

The approach uses computer model simulations to help identify factors affecting eutrophication in the Bay and to get a better understanding of how various point and nonpoint sources and water quality processes affect eutrophication of the subestuaries and nutrient loadings to the Bay. Models describing urban and rural nonpoint-source nutrient loading, stream transport, and estuarine processes will be linked into compatible sets. These sets will be calibrated and tested to determine their accuracy in projecting real-life scenarios. Steps will be taken as follows: (1) develop criteria for selecting analytical tools necessary for effective management of eutrophication in the Bay, (2) develop an inventory of models to be tested and recommend operational procedures for their use, (3) calibrate the sets of models selected, and (4) test each set of models and transfer the technology to EPA and the State.

PRODUCTS:

The products of this study will include (1) a summary report giving present estimates of net nutrient loadings to the Bay and (2) an assessment of the usefulness of computer modeling in predicting and evaluating nutrient loadings including estimates of costs of running the various models.

* Represents 1st-year funding of a multiyear project.

FALL LINE MONITORING OF THE POTOMAC,
SUSQUEHANNA AND JAMES RIVERS

PRINCIPAL INVESTIGATOR(s):

Finch White*
David Grason

PROJECT NUMBER:

EPA-78-D-X0420
Interagency Agreement

PERFORMING ORGANIZATION:

Geological Survey
Water Resources Division
208 Carroll Building
8600 La Salle Road
Towson, MD 21204

EPA PROJECT OFFICER:

Thomas Pheiffer

BUDGET:

EPA Share - (1st year).....	$ 60,000
- (2nd year).....	363,000
Subtotal.....	$423,000**

PROJECT PERIOD:

Begin - 09/01/78
End - 04/01/80

OBJECTIVES:

This project will characterize the inputs from major fresh water sources to the Chesapeake Bay system during the data collection period. The Susquehanna, Potomac and James Rivers will be monitored for chemical, physical and organic components in both qualitative and quantitative modes.

SCIENTIFIC APPROACH:

The Susquehanna monitoring site is at Conowingo, MD. The Potomac River is monitored at the Chain Bridge in Washington, D.C. The James River is monitored at Cartersville, VA. Measurements are made for suspended sediment, nutrients, carbon, trace metals, key metals, pesticides, sulfate and major ions, chlorophyll-A, total solids, and discharge. Scheduled frequencies of measurement vary from daily to monthly depending upon type of measurement. Supplemental sampling is used to assess the impact of extreme events (e.g., storms).

PRODUCTS:

Study results will provide estimates of pollutant loadings for use in evaluating the effects of existing and future land use, water use, and regional economic developments in the freshwater portions of the Susquehanna, Potomac and James River Basins. This information is also needed to validate water quality models of the Chesapeake Bay system.

* Project Manager.
** Represents funding of years 1 and 2 of a 3-year project.

ASSESSMENT OF NUTRIENTS FROM VARIOUS SOURCES

PRINCIPAL INVESTIGATOR(s):
Gerard Laniak

PROJECT NUMBER:
R804917

PERFORMING ORGANIZATION:
School of Public Health
University of North Carolina
at Chapel Hill
Chapel Hill, NC 27514

EPA PROJECT OFFICER:
Norbert Jaworski

BUDGET:
EPA Share.....$15,000
TOTAL.....$15,000

PROJECT PERIOD:
Begin - 06/01/78
End - 12/31/79

OBJECTIVES:

This project seeks to determine a gross estimate of the relative magnitude of input and significance of different sources of nutrients on the water quality of the Bay. These sources include point, nonpoint and atmospheric sources of nutrients.

SCIENTIFIC APPROACH:

The approach uses a sequence of calculations to determine mass balances of nutrients in the Bay. Calculations will be performed according to procedures supplied by EPA, and physical characteristics, flushing times and tributary input data will be supplied by EPA from records compiled over the past 10 years.

PRODUCTS:

A report will be issued summarizing the significance of the different sources of nutrients on the water quality of the Chesapeake Bay in terms of nutrient concentrations and dissolved oxygen levels in different zones of the Bay.

LAND USE AND POINT SOURCE NUTRIENT LOADING
IN THE CHESAPEAKE BAY REGION

PRINCIPAL INVESTIGATOR(s):
Benjamin J. Mason

PROJECT NUMBER:
68-01-4144

PERFORMING ORGANIZATION:
GEOMET, Incorporated
15 Firstfield Road
Gaithersburg, MD 20760

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:
EPA Share $20,308
TOTAL..... $20,308

PROJECT PERIOD:
Begin - 07/26/79
End - 10/19/79

OBJECTIVES:

The objectives are to develop land use information to be used by the Chesapeake Bay Program in developing nutrient loading scenarios to (1) determine the Bay's water quality response to those loadings, (2) identify point source loadings of nutrients from municipalities and industry for the years 1980 and 2000. Information on land use will be developed on a watershed basis for the years 1980 and 2000.

SCIENTIFIC APPROACH:

The approach will locate, review and synthesize existing land use data by watershed for the Chesapeake Bay drainage basin. Minimum delineation will include forested, urban and cultivated/noncultivated agricultural areas. Slope gradient and soil type will be added to the information base. Data sources include: USDA (Soil Conservation Service and the Economics - Statistics and Cooperative Service), NASA, USGS, U.S. Army Corps of Engineers, U.S. Army Map Service, EPA and the State planning agencies.

PRODUCTS:

The project will produce a final report with data showing (1) 1980 land use patterns in the Bay drainage by watershed, (2) projected land use changes for the year 2000, (3) major municipal and industrial nitrogen and phosphorus (N and P) loadings for 1980, and (4) projected N and P loads for the year 2000.

CHESAPEAKE BAY CIRCULATION MODEL

PRINCIPAL INVESTIGATOR(s):
Robert Shubinski

PROJECT NUMBER:
68-01-5125

PERFORMING ORGANIZATION:
Water Resources Engineers, Inc.
8001 Forbes Place
Springfield, VA 22151

EPA PROJECT OFFICER:
Thomas Pheiffer

BUDGET:
EPA Share.....$249,949
TOTAL $249,949

PROJECT PERIOD:
Begin - 03/01/79
End - 07/01/81

OBJECTIVES:

The objectives of this project are (1) to produce an operational model of the water circulation of the Bay consisting of software and data which states the basic hydraulic and hydrodynamic phenomena and (2) to provide technology transfer to assure that the EPA staff fully trained to use and understand both model and support documentation.

SCIENTIFIC APPROACH:

The approach used in the development of the Bay model is to (1) select the optimal model (or models), (2) develop and modify the computer code, (3) apply initial calibration, (4) perform sensitivity analysis of both internal and external parameters and coefficients, (5) design a field data collection effort to produce information which will help maximize the model's predictive capabilities, (6) acquire the field data, (7) refine model calibration, (8) verify that the model is a "reliable" working model of the Bay, and (9) conduct workshops and seminars to assure that EPA personnel and others are fully trained to use the model.

PRODUCTS:

The product will be a fully operational hydraulic and hydrodynamic computerized model of the Bay.

WATER QUALITY LABORATORY FOR CHESAPEAKE BAY AND ITS SUBESTUARIES AT HAMPTON INSTITUTE

PRINCIPAL INVESTIGATOR(s):
Larry T. Cheung

PROJECT NUMBER:
R806229

PERFORMING ORGANIZATION:
Department of Chemistry and Physics
Hampton Institute
Hampton, Virginia 23668

EPA PROJECT OFFICER:
Thomas Nugent

BUDGET:

EPA Share	$315,521
Performing Organization Share	16,606
TOTAL	$332,127

PROJECT PERIOD:
Begin - 09/04/78
End - 11/30/79

OBJECTIVES:

This project evaluates the water quality (chemical and biological) of the Chesapeake Bay and selected subestuaries. Water quality information will be correlated with LANDSAT imagery. A helicopter-borne water quality sampling system will be evaluated.

SCIENTIFIC APPROACH:

Program modeling requirements will guide the selection of locations for water samples. The helicopter-borne water quality monitoring system will record depth, pH, conductivity/salinity, temperature and dissolved oxygen. Those measurements will be compared with LANDSAT observations made during selected overpasses. The resulting data will be compared for accuracy and will be used in evaluating physical, biological and oxygen-related parameters, as well as concentration of toxicants and levels of nutrients.

PRODUCTS:

The products of this study will include: (1) a statement of the relative efficiencies and reliability of helicopter versus LANDSAT water quality monitoring, and (2) data which will be used to refine Bay models developed to assist policymakers in answering questions related to the pollution control in the Bay system.

ENVIRONMENTAL MANAGEMENT PROGRAM AREA

In authorizing the Environmental Protection Agency to undertake the Chesapeake Bay Program study, Congress specifically directed the Agency to examine Bay management. Three priority research tasks have been identified as vital to a better understanding of the factors affecting and influencing the Bay decision process. They are: (1) identify, review and catalog regional water resources management agencies, (2) review and catalog Bay management agencies, and (3) analyze the effectiveness of present Bay management mechanisms.

This series of research tasks will assure that all the related components of the Bay Program work together smoothly and efficiently to achieve the objective of a better Bay. The Environmental Management Program includes tasks to support and refine the existing management strategies and to analyze alternative scenarios for Bay management.

ENVIRONMENTAL MANAGEMENT PROJECTS

PREPARATION OF A STRATEGY AND PLAN OF ACTION FOR DESIGNING THE RESEARCH OF MANAGEMENT RESOURCES FOR THE CHESAPEAKE BAY AREA

PRINCIPAL INVESTIGATOR(s):
John Keene

PROJECT NUMBER:
X-003149-01

PERFORMING ORGANIZATION:
Department of City and Regional Planning
University of Pennsylvania
3400 Walnut Street
Philadelphia, Pennsylvania 19104

EPA PROJECT OFFICER:
Gregory McGinty

BUDGET:

EPA Share	$14,336
Performing Organization Share	1,110
TOTAL	$15,446

PROJECT PERIOD:
Begin - 8/01/78
End - 6/30/79

OBJECTIVES:

The objective of the project is to assist in the development of a research program; the products of which will result in better coordination and more efficient management of the Bay's resources.

SCIENTIFIC APPROACH:

The project will provide input into the development of a research plan, evaluate proposals submitted in response to the research plan and assist the work group in overseeing the conduct of the study.

PRODUCTS:

The product of this effort will be a research plan to investigate the management structure protecting the environmental quality of the Chesapeake Bay.

ENVIRONMENTAL MANAGEMENT IN THE CHESAPEAKE BAY

PRINCIPAL INVESTIGATOR(s):
David Harrison
William Nye

PROJECT NUMBER:
X-003200-01

PERFORMING ORGANIZATION:
Environmental Law Institute
1346 Connecticut Avenue, N.W.
Washington, D.C. 20036

EPA PROJECT OFFICER:
Gregory McGinty

BUDGET:

EPA Share	$150,802
Performing Organization Share	8,122
TOTAL	$158,924

PROJECT PERIOD:
Begin - 06/25/79
End - 12/31/80

OBJECTIVES:

This study pursues three objectives: (1) to describe the present system of environmental management at all levels for the Chesapeake Bay, (2) to propose alternative management systems where warranted, and (3) to estimate the costs and benefits of such changes.

SCIENTIFIC APPROACH:

Resources for the Future and the Conservation Foundation will assist the Environmental Law Institute in performing three major tasks: (1) identify Federal, interstate, state, and local government agencies involved with Bay management, (2) describe the roles of each agency in managing the Bay, and (3) develop procedural and institutional alternatives that will improve environmental management of the Bay. All major tasks will be undertaken within the context of researching management relative to the technical areas of Toxics, Eutrophication and Submerged Aquatic Vegetation.

PRODUCTS:

The results of this study will serve to coordinate the separate study areas (Toxics, Eutrophication, Submerged Aquatic Vegetation, Public Participation) into an integrated management plan for maintaining the quality of the Chesapeake Bay system.

STATE PARTICIPATION

Representative agencies from both Maryland and Virginia State governments support the Chesapeake Bay Program by providing key coordination links on both inter- and intrastate levels. At this time the states are concentrating on assessing Bay user needs, identifying and reviewing existing programs, and designing and implementing new programs when necessary.

The close coordination and involvement by the states allows both the State government and the Chesapeake Bay Program office to most efficiently allocate their resources in identifying and resolving the Bay water quality problems.

STATE PARTICIPATION PROJECTS

DEVELOPMENT AND COORDINATION OF TECHNICAL ASSESSMENTS, SCIENTIFIC PLANNING AND DATA ORGANIZATION FOR THE CHESAPEAKE BAY PROGRAM
STATE OF MARYLAND

PRINCIPAL INVESTIGATOR(s):
Howard Wilson*

PROJECT NUMBER:
R80587401

PERFORMING ORGANIZATION:
Water Resources Administration
Maryland Department of Natural Resources
Tawes State Office Building
Annapolis, MD 21401

EPA PROJECT OFFICER:
William Cook

BUDGET:

EPA Share	$338,130
Performing Organization Share	18,670
TOTAL	$356,800

PROJECT PERIOD:
Begin - 1/11/78
End - 1/10/80

OBJECTIVES:

Primary program objective is to facilitate state participation in all phases of the Chesapeake Bay Program. Assistance and support will be provided to EPA through planning, technical support and assistance, data compilation and processing, scientific planning and technical program development and implementation.

SCIENTIFIC APPROACH:

The Maryland Department of Natural Resources, Water Resources Administration, functioning in a lead agency capacity, serves as the primary liaison between the Chesapeake Bay Program and all Maryland State agencies. Interaction between the Program and the State occurs through State agency personnel participation on policy, management and working level committees.

PRODUCTS:

Major products include extensive state participation leading to the development and implementation of a cooperative Chesapeake Bay Program, and the investigation of environmental problems besetting the Chesapeake Bay in a context receptive to the needs of those agencies responsible for the management and regulation of the Bay, its resources, and uses.

* Project Manager.

DATA ORGANIZATION, TECHNICAL SUPPORT AND COORDINATION FOR THE ENVIRONMENTAL PROTECTION AGENCY'S CHESAPEAKE BAY PROGRAM
COMMONWEALTH OF VIRGINIA

PRINCIPAL INVESTIGATOR(s):
Robert V. Davis*

PERFORMING ORGANIZATION:
Virginia State Water Control Board
2111 N. Hamilton Street
Richmond, VA 23230

PROJECT NUMBER:
R805859

EPA PROJECT OFFICER:
Gregory McGinty

BUDGET:
EPA Share $323,215
Performing Organization
Share..... 36,600
TOTAL.....$359,815

PROJECT PERIOD:
Begin - 6/5/78
End - 6/4/80

OBJECTIVES:

Primary program objective is to facilitate state participation in all phases of the Chesapeake Bay Program. Assistance and support will be provided to EPA through planning, technical support and assistance, data compilation and processing, scientific planning and technical program development and implementation.

SCIENTIFIC APPROACH:

The Virginia State Water Control Board, functioning in a lead-agency capacity, serves as the primary liaison between the Chesapeake Bay Program and all Virginia State agencies. Interaction between the Program and the State occurs through State agency personnel participation on policy, management and working level committees.

PRODUCTS:

Major products include extensive state participation leading to the development and implementation of a cooperative Chesapeake Bay Program, and the investigation of environmental problems besetting the Chesapeake Bay in a context receptive to the needs of those agencies responsible for the management and regulation of the Bay, its resources, and uses.

* Project Manager.

PUBLIC PARTICIPATION

Citizens, by being active and concerned about community issues, play an important role in influencing both the direction and magnitude of government actions. The process of public participation results in two immediate benefits: (1) government leaders become aware of and more responsive to public concerns, and (2) the citizens can better understand the efforts undertaken by government in response to problems.

The Chesapeake Bay is fortunate to have a public that is actively concerned about the environmental health of the Bay. The programs described under Public Participation are designed to facilitate a two-way communication flow between the citizens in the Bay area and the Chesapeake Bay Program management.

CHESAPEAKE BAY PROGRAM'S PUBLIC PARTICIPATION PROGRAM

PRINCIPAL INVESTIGATOR(s):
George M. Hagerman

PROJECT NUMBER:
T900748

PERFORMING ORGANIZATION:
Citizens Program for the Chesapeake Bay, Inc.
5 East Queen Way
Hampton, VA 23669

EPA PROJECT OFFICER:
Anthony Donatoni

BUDGET:
EPA Share.....$283,407
Performing Organization Share..... 20,197
TOTAL.....$303,604

PROJECT PERIOD:
Begin - 10/01/77
End - 09/30/78

OBJECTIVES:

The objectives of the Public Participation Program are: (1) to raise the level of public awareness concerning the environment of the Chesapeake Bay, (2) to increase the public's understanding of the Chesapeake Bay Program and its goals and objectives, (3) to provide Chesapeake Bay Program management with citizen input concerning the Bay, (4) and to involve the public in the Program's decisionmaking process.

SCIENTIFIC APPROACH:

During the first year of the Public Participation Program, a variety of communication approaches were used to facilitate a better understanding by the public of the activities and goals of the Chesapeake Bay Program and to give the Bay Program management a clear understanding of the citizen's priorities, needs and concerns regarding the Bay. Specific actions taken include: (1) a 16-member Citizens Steering Committee was established, (2) seven forums were sponsored, (3) presentations on the Bay Program were delivered at 37 citizen meetings, (4) a 52-minute film was produced and telecast by Bay-area stations, (5) a slide presentation was developed and has been used at each of the meetings, and (6) a bimonthly newsletter was mailed to 5,000 individuals. Numerous fact sheets, brochures, flyers, newsletters, press releases and posters have also been developed and widely circulated.

PRODUCTS:

While the level of citizen awareness is difficult to measure without sophisticated and extensive opinion polls, public exposure to the information stream and management exposure to the CSC and Bay citizens both suggest that the level of mutual understanding has been raised.

CHESAPEAKE BAY PROGRAM'S PUBLIC PARTICIPATION PROGRAM

PRINCIPAL INVESTIGATOR(s):
Frances Flanigan

PROJECT NUMBER:
T900879

PERFORMING ORGANIZATION:
Citizens Program for the Chesapeake Bay, Inc.
6600 York Road
Baltimore, MD 21212

EPA PROJECT OFFICER:
William Cook

BUDGET:
EPA Share.....$383,704
Performing Organization Share..... 30,197
TOTAL.....$413,901

PROJECT PERIOD:
Begin - 10/01/78
End - 12/31/79

OBJECTIVES:

This project continues the work of the first-year program executed under project number T900748 with the objectives of: (1) raising the level of public awareness and understanding of the Chesapeake Bay Program's goals and objectives, and (2) providing program management with citizen input concerning the Bay and the Bay program.

SCIENTIFIC APPROACH:

The Citizen's Program for the Chesapeake Bay, Inc. (CBCP) has established an office in Hampton, Virginia and one in Baltimore, Maryland to enable it to effectively reach Bay citizens. A network of staff located regionally around the Bay enables CPCB to have grass roots contact with organizations and individuals. CPCB is working closely with other public participation efforts (i.e., 208, CZM, Corps of Engineers, Sea Grant) to achieve a necessary level of coordination and to eliminate duplication.

PRODUCTS:

The CPCB effort has maintained a Citizens Steering Committee whose function is to advise EPA on the conduct of the Chesapeake Bay Program. Other products include the continuation and enhancement of the 1st year activities and Steering Committee reports, posters, a miniproject program, a newspaper supplement on the Bay Program, a computerized mailing list of organizations and individuals interested in the Bay, a multiprogram exhibit, a set of radio and television public service announcements and workshops designed to acquaint the public with the Bay Program and give them an opportunity to become involved in it.

DATA MANAGEMENT PROJECT

In the process of evaluating the ecological health of an estuarine system such as the Chesapeake Bay, large and complex sets of data are generated and must be maintained. Scientists and researchers rely heavily on both data interpretation and computer modeling techniques to better understand the interrelationships of the factors affecting the Bay.

Data management must provide for software design, implementation, and system operations necessary to support the complex data sets developed through Chesapeake Bay Program projects.

AUTOMATED DATA PROCESSING SUPPORT FOR THE CHESAPEAKE BAY PROGRAM

PRINCIPAL INVESTIGATOR(s):
Russ Ryder

PROJECT NUMBER:
68-01-3840

PERFORMING ORGANIZATION:
Computer Sciences Corporation
Applied Technology Division
6565 Arlington Boulevard
Falls Church, VA 22046

EPA PROJECT OFFICER:
Lowell Bahner

BUDGET:
EPA Share.....$167,000
TOTAL.....$167,000

PROJECT PERIOD:
Begin - 04/01/79
End - 03/31/80

OBJECTIVES:

This contract provides the Bay Program with long-term and comprehensive capabilities in ADP software development, computer operations and data management. Categories of activity include management of financial data, project information, raw observational data, statistical analyses, graphic and tabular presentation and real-time computation.

SCIENTIFIC APPROACH:

Staff with capabilities in software development, hardware operation and data management will provide direct support to the Chesapeake Bay Program. These professionals will (1) operate the PDP 11/70 computer in Annapolis, (2) provide support for the remote use of the Agency's computer facilities through interface procedures, (3) achieve fluency in the use and application of EPALOG, EPALIT, and STORET data processing systems, (4) provide programming support to necessary software development and modifications as required, (5) oversee the collection, organization and presentation of data, and (6) prepare and implement a comprehensive data management plan.

PRODUCTS:

(1) A financial data reporting system, (2) assistance in supplying all appropriate data products of project activity to the STORET data processing system, (3) a Bay Program data management plan and implementation system, (4) operation of the PDP 11/70 mini-computer, and (5) stored, structured and secured data files.